

M6 XEOTV: 1080P UNDERWATER GEOTAGGED VIDEO WITH DEFERRED FILTERING

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Abstract

We present a system to record high definition underwater video with geotagging information. This system allows the user to detect salient features of the seabed and map them accurately. Those features are often difficult to perceive due to the complex recording environment, therefore image filters are used to highlight them. However standard compression algorithms do not store enough information to apply the most sensitive filters, and if the video is compressed with wrong filter settings some details are lost. Our system is designed to compress high definition video while retaining most raw data, and thus allows the user to apply different image filters offline. With this system, it is possible to analyze and cartography sections of the seabed with an unprecedented amount of detail.

Keywords – Video, Geotagging, Cartography, Seabed

INTRODUCTION

XXI century is said to be the century of our seas. The XX century saw an incredible technological development, but only a small part of was devoted to the seas. And when it was, it exploded the marine and subsea resources. XeoTV is a tool we hope that will contribute to make people 'see' the enormous richness of the seafloor and how much all of us depend on it.

SEABED RECORDINGS UNTIL NOW

Although there are many records of the seafloor, those intensive recordings do not have a real value because they were stored in analog formats (VHS, Beta, etc.). Some systems allow manual insertion of GPS coordinates in the streams, but the task is difficult due to the lack of visual references in the seabed. In 2010 we developed XeoTV, an application to record submarine video to a computer, and a visualization tool, Visor XeoTV, which in two windows, show simultaneously the submarine video and a georeferenced map. The map shows a line with the route where the video has been recorded (trac) and a point in it showing the exact point corresponding to the frame of the video that is being shown in the video window.

HIGH DEFINITION VIDEO RECORDING

The recording system (Fig 1) includes a custom designed camera with 3.1MP of resolution. It provides 1080p video at 12fps or 720p at 24fps, selectable by

the user. Inside the camera housing, an integrated monitoring agent adjusts the camera parameters online to best match the requirements of the operator and the perceived scenario. Raw data is transmitted to an embedded processor board to be stored in a SD-Card. Each color channel is stored independently using high quality JPEG settings and those settings are throttled to use around 1.7 of the 4 available CPU cores, leaving ample margin to perform management tasks and to transmit a lower resolution, filtered image to the camera operator. The management is performed through Ethernet, which can be copper or fiber based depending on the distance requirements.

GEOLOCALIZATION

GPS data is captured on the surface and transmitted to the underwater system through the management link. This link is also used to ensure correct clock synchronization between GPS and the recording system, required for accurate seabed localization. The underwater system compensates for distance and depth, and stores modified GPS coordinates corresponding to the current seabed location alongside the video. Interpolation is used between GPS updates to tag accurately each frame.

ANALYZING RECORDED VIDEOS

The geotagged video provided by the capture system is linked to a map provided by the user. The interface (Fig. 2) is split in two main sections. The right section allows the user to browse the map and displays each recorded trajectory; there the user can select the seabed section that needs to be analyzed and it will be displayed in the left section alongside relevant information regarding that section. Several browsing capabilities are provided, including temporal and spatial displacements, different zoom options and several filtering capabilities, and the interface can be used to annotate and highlight interesting events which will be reflected in the map.

CONCLUSIONS

Recording the marine seabed has become specially easy and useful with the XeoTV and VisorXeoTV tools developed in HCTech in 2010. This paper describes a new step in seabed video recordings. FullHD resolution with raw storage allows for offline filtering to get superior image quality. It is a new interesting feature to the geotagged video and the VisorXeoTV tool.

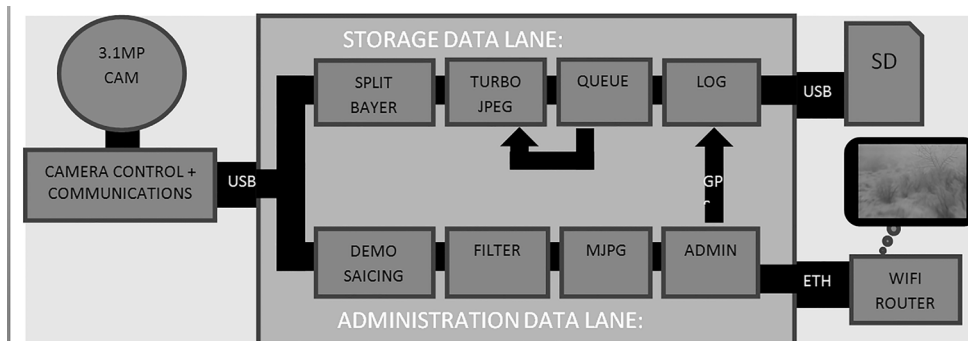


Figure 1 - The recording system. Video is captured at high resolution from the camera and sent raw to the processing board (center box). There is split in two lanes. The storage lane stores the unfiltered data in a SD card. JPEG compression is throttled using the Queue length as indicator. The admin lane sends a live feed to the operator using Ethernet and WIFI.

Figure 2 - The user interface links the video recordings with the map. The current visualized frame is highlighted in the map as a red dot, and all available trajectories are marked with green lines. Note the Point-Of-Interest marked white (WPT001).

